FORM PTO-1390 (Modified) (REV 10-95) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 1928

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR): 10/018649

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE 00/01838	JUNE 6, 2000	JUNE 19, 1999

TITLE OF INVENTION: **PIEZOELECTRIC ACTUATOR**

APPLICANT(S) FOR DO/EO/US: **Friedrich BOECKING**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
    A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☐ Other items or information:

EL 755324549US

U.S. APPLICATION NO. (IF KNOWN, SEE 37 C	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/018649	PCT/DE 00/01838	1928

20. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS PTO USE ONLY
☐	Search Report has been prepared by the EPO or JPO	**$930.00**
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482)	**$720.00**
☐	No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))	**$790.00**
☒	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO	**$1,070.00**
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	**$98.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =	**$890.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	9 - 20 =	0	x $18.00	**$0.00**	
Independent claims	1 - 3 =	0	x $80.00	**$0.00**	
Multiple Dependent Claims **(check if applicable)**.			☐	**$0.00**	
TOTAL OF ABOVE CALCULATIONS =				**$890.00**	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable).**			☐	**$0.00**	
SUBTOTAL =				**$890.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +				**$0.00**	
TOTAL NATIONAL FEE =				**$890.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☐	**$0.00**	
TOTAL FEES ENCLOSED =				**$890.00**	
				Amount to be: refunded	$
				charged	$

☐ A check in the amount of to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **19-4675** in the amount of **$890.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-4675** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

STRIKER, STRIKER & STENBY
103 EAST NECK ROAD
HUNTINGTON, NEW YORK 11743

SIGNATURE

MICHAEL J. STRIKER
NAME

27233
REGISTRATION NUMBER

DECEMBER 18, 2001
DATE

10/018649

JC13 Rec'd PCT/PTO 18 DEC 2001

UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Group: Attorney Docket # 1928

Applicant(s) : BOECKING, F.

Serial No. :

Filed :

For : PIEZOELECTRIC ACTUATOR

10018649.032502

SIMULTANEOUS AMENDMENT

December 18, 2001

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

S I R S:

Simultaneously with filing of the above identified application please amend the same as follows:

In the Claims:

Cancel all claims without prejudice.

Substitute the claims attached hereto.

REMARKS:

This Amendment is submitted simultaneously with filing of the above identified application.

With the present Amendment applicant has amended the claims so as to eliminate their multiple dependency.

Consideration and allowance of the present application is most respectfully requested.

Respectfully submitted,

Michael J. Striker
Attorney for Applicant(s)
Reg. No. 27233

Claims

1. Piezoelectric actuator having
- a piezoelectric element (2; 21) for actuating a mechanical component with a pulling or pushing force, and a compensating element (3; 22), wherein the piezoelectric element (2) and the compensating element (3; 22) basically have the same temperature expansion coefficients, and wherein
- the compensating element (3; 22) is mechanically coupled to the piezoelectric element (2; 21) in such a fashion that the temperature-induced expansions of the piezoelectric element (2; 21) and the compensating element (3; 22) cancel each other out in the effective direction in such a fashion that the actuating element remains in its position.

2. Piezoelectric actuator according to claim 1, characterized in that
- a heat transfer compound (12) is located between the piezoelectric element (2; 21) and the compensating element (3; 22).

3. Piezoelectric actuator according to claim 1 [or 2], characterized in that
- the piezoelectric element (2; 21) is supported on one end on a fixed support plate (9), which fixed support plate (9) bears against the housing (7) for the piezoelectric actuator (1; 20) via a spring (10) and which is connected at the other end to a pretensioning spring (6; 23) via a pressing plate (11; 24), which pretensioning spring (6; 23), in turn, is held against the fixed support plate (9) with its other end, and that
- the compensating element (3; 22) basically lies parallel to the piezoelectric element (2; 21) and is also held against the fixed support plate (9) with one end and solidly abuts the housing (7) with the other end.

4. Piezoelectric actuator according to claim 3, characterized in that

- the pretensioning spring (6) and the piezoelectric element (2) are located in tandem.

5. Piezoelectric actuator according to claim 4, characterized in that
- the movable end of the piezoelectric element (2) is connected to the pressing plate (5) via a tightening strap (8).

6. Piezoelectric actuator according to claim 3, characterized in that
- the pretensioning spring (23) and the piezoelectric element (21) are situated parallel to each other.

7. Piezoelectric actuator according to [one of the preceding claims] claim 1, characterized in that
- the pretensioning spring is formed out of at least one zigzag spring (6; 23).

8. Piezoelectric actuator according to [one of the preceding claims] claim 1, characterized in that
- the piezoelectric element (2; 21) is composed of a multilayer structure of transversely arranged, ceramic piezoelectric plies that become longer in the effective direction when an external electric voltage is applied, and the compensating element (3; 22) is made of ceramic.

9. Piezoelectric actuator according to [one of the claims 1 through 6] claim 1, characterized in that
- the piezoelectric element (2, 21) is composed of a multilayer structure of transversely arranged, ceramic piezoelectric plies that become longer in the effective direction when an external electric voltage is applied, and that

- the compensating element (3; 22) is composed of piezoelectric plies arranged in the longitudinal direction that become shorter in the effective direction when an external electric voltage is applied.

Claims

1. Piezoelectric actuator having
- a piezoelectric element (2; 21) for actuating a mechanical component with a pulling or pushing force, and a compensating element (3; 22), wherein the piezoelectric element (2) and the compensating element (3; 22) basically have the same temperature expansion coefficients, and wherein
- the compensating element (3; 22) is mechanically coupled to the piezoelectric element (2; 21) in such a fashion that the temperature-induced expansions of the piezoelectric element (2; 21) and the compensating element (3; 22) cancel each other out in the effective direction in such a fashion that the actuating element remains in its position.

2. Piezoelectric actuator according to claim 1, characterized in that
- a heat transfer compound (12) is located between the piezoelectric element (2; 21) and the compensating element (3; 22).

3. Piezoelectric actuator according to claim 1, characterized in that
- the piezoelectric element (2; 21) is supported on one end on a fixed support plate (9), which fixed support plate (9) bears against the housing (7) for the piezoelectric actuator (1; 20) via a spring (10) and which is connected at the other end to a pretensioning spring (6; 23) via a pressing plate (11; 24), which pretensioning spring (6; 23), in turn, is held against the fixed support plate (9) with its other end, and that
- the compensating element (3; 22) basically lies parallel to the piezoelectric element (2; 21) and is also held against the fixed support plate (9) with one end and solidly abuts the housing (7) with the other end.

4. Piezoelectric actuator according to claim 3, characterized in that

- the pretensioning spring (6) and the piezoelectric element (2) are located in tandem.

5. Piezoelectric actuator according to claim 4, characterized in that
- the movable end of the piezoelectric element (2) is connected to the pressing plate (5) via a tightening strap (8).

6. Piezoelectric actuator according to claim 3, characterized in that
- the pretensioning spring (23) and the piezoelectric element (21) are situated parallel to each other.

7. Piezoelectric actuator according to claim 1, characterized in that
- the pretensioning spring is formed out of at least one zigzag spring (6; 23).

8. Piezoelectric actuator according to claim 1, characterized in that
- the piezoelectric element (2; 21) is composed of a multilayer structure of transversely arranged, ceramic piezoelectric plies that become longer in the effective direction when an external electric voltage is applied, and the compensating element (3; 22) is made of ceramic.

9. Piezoelectric actuator according to claim 1, characterized in that
- the piezoelectric element (2, 21) is composed of a multilayer structure of transversely arranged, ceramic piezoelectric plies that become longer in the effective direction when an external electric voltage is applied, and that

- the compensating element (3; 22) is composed of piezoelectric plies arranged in the longitudinal direction that become shorter in the effective direction when an external electric voltage is applied.

PIEZOELECTRIC ACTUATOR

Prior Art

The invention provides a piezoelectric actuator, e.g., for actuating a mechanical component such as a valve or the like, according to the generic features of the primary claim.

It is generally known that, by utilizing the "piezoelectric effect", a piezoelectric element can be built using a material having a suitable crystal structure. When an external electrical voltage is applied, a mechanical reaction of the piezoelectric element takes place that represents a push or a pull in a specifiable direction depending on the crystal structure and the application site of the electrical voltage.

The piezoelectric actuators named previously are often used to position valves. In this case it should be noted, among other things, that their lifting ability for actuating a valve tappet, for example, is relatively small. On the other hand, the different thermal expansion of the ceramic of the piezoelectric element and the housing leads to problems; the piezoelectric element has a very low temperature expansion and the housing, which is usually metallic, has a positive temperature expansion, which can lead to a drifting of the position of the valve tappet without control by the piezoelectric element.

So far, such perturbing actions could only be diminished in the usual fashion by using very expensive materials, such as invar, which have a negative temperature expansion. Another method was to connect a material with high temperature expansion in series with the piezoelectric element, which, however, reduces the stiffness of the system and, therefore, the acutator force.

Advantages of the Invention

The piezoelectric actuator already explained hereinabove, which can be used to actuate a mechanical component, for example, advantageously comprises a piezoelectric element with which, according to the invention, a compensating element is arranged in parallel. It is particularly advantageous thereby that the piezoelectric element and the compensating element basically have the same temperature expansion coefficients, so that the temperature-induced expansions of the piezoelectric element and the compensating element—when the two elements are mechanically installed in suitable fashion—cancel each other out in the effective direction in such a fashion that an actuating element solidly connected to a pressing plate of the piezoelectric element remains in its position. It can therefore be achieved in simple fashion that a metallic housing, e.g., made of steel, is still used for the piezoelectric actuator, and the piezoelectric element can be fastened in the housing in such a fashion that the compensating element for temperature compensation is always solidly connected to the piezoelectric element. In an especially preferred exemplary embodiment of the invention, a heat transfer compound is located between the piezoelectric element and the compensating element, with which a good temperature compensation between the compensating element and the piezoelectric element can be produced.

According to the invention and in advantageous fashion, the piezoelectric element can be pretensioned in itself in simple fashion. The piezoelectric element is supported on one end against a fixed support plate that bears against a housing for the piezoelectric actuator via a spring. At the other end, the piezoelectric element is connected via a pressing plate to a pretensioning spring which, in turn, is held with its other end against the fixed support plate. The compensating element thereby lies basically parallel to the piezoelectric element and also bears against the fixed support plate at one end; at the other end, the compensating element solidly abuts the housing.

The pretensioning spring and the piezoelectric element can thereby be arranged in simple fashion in tandem, for example, whereby the movable end of the piezoelectric element can be connected to the pressing plate via a tightening strap. It is also possible, however, that the pretensioning spring and the piezoelectric element are situated parallel to each other, whereby, for instance, two symmetrically located zigzag springs can be located in the heat transfer compound as pretensioning springs that are also parallel to each other.

The proposed interconnection of the piezoelectric element, the ceramic ring, and the pretensioning spring is solidly braced with the housing, whereby the pretensioning forces are much higher than the switching forces of the piezoelectric element, and the pretensioning spring makes a temperature compensation motion relative to the housing possible. The magnitude of the pretension can thereby be produced in simple fashion via a mounting nut. Even when the temperature expansion coefficient of the compensating element does not correspond to that of the piezoelectric element, the temperature compensation can be "tuned" via the length of the compensating element. In the exemplary embodiment, the support of the compensating element on the mounting nut represents the common zero point, which mounting nut is solidly connected to the housing.

This and further features of preferred further developments of the invention arise out of the claims as well as the description and the drawings, whereby the individual features can be realized alone or in plurality in the form of subcombinations in the exemplary embodiment of the invention and in other fields, and they can represent advantageous and inherently patentable embodiments, for which protection is claimed here.

Drawing

Exemplary embodiments of the temperature-compensated piezoelectric actuator according to the invention, e.g., for the positioning of a valve, are explained using the drawing.

Figure 1 is a sectional view through a piezoelectric actuator held with a tightening strap with a compensating element and a pretensioning spring located behind it, and

Figure 2 is a sectional view through a piezoelectric actuator with a compensating element and pretensioning springs located parallel to each other.

Description of the Exemplary Embodiments

Figure 1 shows a piezoelectric actuator that comprises a piezoelectric element 2 that is built in known fashion out of piezoelectric plies of a quartz material having a suitable crystal structure, so that, by utilizing the "piezoelectric effect", when an external electrical voltage is applied to electrodes not shown in this figure, a mechanical reaction of the piezoelectric actuator 1 takes place. In the piezoelectric actuator 1 according to Figure 1, the piezoelectric element 2 is made of ceramic and a compensating element 3 is also made of ceramic, but without a "piezoelectric effect".

The piezoelectric element 2 is surrounded by a tightening strap 4 that is welded to a pressing plate 5 at the top, which serves as the mount for a zigzag spring 6 as the tensioning spring. A base plate 11, with which the piezoelectric element 2 abuts, lies between the compensating element 3 which solidly bears against the housing 7 or a mounting nut on the other side, and a sleeve arrangement 8,

which, in turn, bears against a fixed support plate 9. The fixed support plate 9, in turn, is held against the housing 7 via a spring 10 for the compensating element 3. The pretensioning spring 6 is thereby held between the pressing plate 5 and the fixed support plate 9. In the exemplary embodiment, an actuation of the piezoelectric actuator 1 leads to an axial expansion of the piezoelectric element 2 and, therefore, to an axial motion of an actuating element not visible here.

A heat transfer compound 12 is applied between the piezoelectric element 2 and the compensating element 3, which makes an optimal temperature compensation of these two elements possible. Since the piezoelectric element 2 and the compensating element 3 basically have the same temperature expansion coefficients, the temperature-induced expansions of the piezoelectric element 2 and the compensating element 3 lead to a cancellation of the influences of both elements 2 and 3 in the effective direction with the proposed mechanical installation. The actuating element can therefore remain in its position.

A second exemplary embodiment of a piezoelectric actuator 20 is shown in Figure 2, whereby the equally-acting components are labelled with the same reference numerals as in Figure 1. In the arrangement according to Figure 2 as well, a piezoelectric element 21 and a compensating element 22 are produced out of a ceramic materal with nearly identical temperature expansion coefficients. Zigzag springs 23, as pretensioning springs, arranged in parallel, and a heat transfer compound 12 are located here between the elements 21 and 22. In this exemplary embodiment as well, an actuation of the piezoelectric actuator 20 leads to an axial expansion of the piezoelectric element 21 and, therefore, to an axial motion of an actuating element—guided by a pressing plate 24 and not shown here—against the pretension of the pretensioning springs 23.

Since, in this case as well, the piezoelectric element 21 and the compensating element 22 basically have the same temperature expansion coefficients, the temperature-induced expansions of the piezoelectric element 21 and the

compensating element 22 lead to a cancellation of the influences of the two elements 21 and 22 in the effective direction with the proposed mechanical installation. The actuating element solidly connected to the pressing plate 24 of the piezoelectric element 21 can therefore remain in its position.

Claims

1. Piezoelectric actuator having
   - a piezoelectric element (2; 21) for actuating a mechanical component with a pulling or pushing force, and a compensating element (3; 22), wherein the piezoelectric element (2) and the compensating element (3; 22) basically have the same temperature expansion coefficients, and wherein
   - the compensating element (3; 22) is mechanically coupled to the piezoelectric element (2; 21) in such a fashion that the temperature-induced expansions of the piezoelectric element (2; 21) and the compensating element (3; 22) cancel each other out in the effective direction in such a fashion that the actuating element remains in its position.

2. Piezoelectric actuator according to claim 1, characterized in that
   - a heat transfer compound (12) is located between the piezoelectric element (2; 21) and the compensating element (3; 22).

3. Piezoelectric actuator according to claim 1 or 2, characterized in that
   - the piezoelectric element (2; 21) is supported on one end on a fixed support plate (9), which fixed support plate (9) bears against the housing (7) for the piezoelectric actuator (1; 20) via a spring (10) and which is connected at the other end to a pretensioning spring (6; 23) via a pressing plate (11; 24), which pretensioning spring (6; 23), in turn, is held against the fixed support plate (9) with its other end, and that
   - the compensating element (3; 22) basically lies parallel to the piezoelectric element (2; 21) and is also held against the fixed support plate (9) with one end and solidly abuts the housing (7) with the other end.

4. Piezoelectric actuator according to claim 3, characterized in that

- the pretensioning spring (6) and the piezoelectric element (2) are located in tandem.

5. Piezoelectric actuator according to claim 4, characterized in that
- the movable end of the piezoelectric element (2) is connected to the pressing plate (5) via a tightening strap (8).

6. Piezoelectric actuator according to claim 3, characterized in that
- the pretensioning spring (23) and the piezoelectric element (21) are situated parallel to each other.

7. Piezoelectric actuator according to one of the preceding claims, characterized in that
- the pretensioning spring is formed out of at least one zigzag spring (6; 23).

8. Piezoelectric actuator according to one of the preceding claims, characterized in that
- the piezoelectric element (2; 21) is composed of a multilayer structure of transversely arranged, ceramic piezoelectric plies that become longer in the effective direction when an external electric voltage is applied, and the compensating element (3; 22) is made of ceramic.

9. Piezoelectric actuator according to one of the claims 1 through 6, characterized in that
- the piezoelectric element (2, 21) is composed of a multilayer structure of transversely arranged, ceramic piezoelectric plies that become longer in the effective direction when an external electric voltage is applied, and that

- the compensating element (3; 22) is composed of piezoelectric plies arranged in the longitudinal direction that become shorter in the effective direction when an external electric voltage is applied.

Abstract

A piezoelectric actuator, e.g., for actuating a mechanical component, is proposed, in which a piezoelectric element (2) for acting on an actuating element (9) with a pulling or pushing force, and a compensating element (3; 20) are provided, wherein the piezoelectric element (2) and the compensating element (3; 20) basically have the same temperature expansion coefficients. The compensating element (3; 20) is mechanically coupled to the piezoelectric element (2) in such a fashion that the temperature-induced expansions of the piezoelectric element (2) and the compensating element (3; 20) cancel each other out in the effective direction in such a fashion that the actuating element (9) remains in its position. A heat transfer compound (12) is located between the piezoelectric element (2; 21) and the compensating element (3; 22).

(Figure 1)

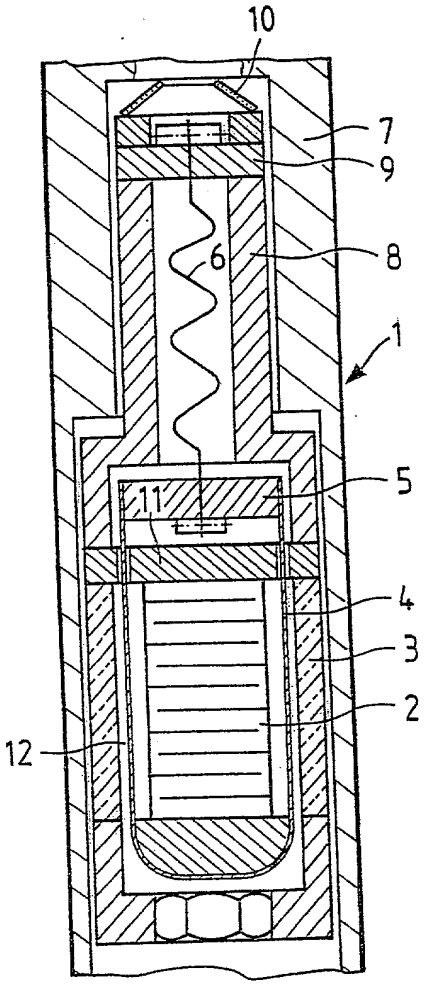

Fig.1

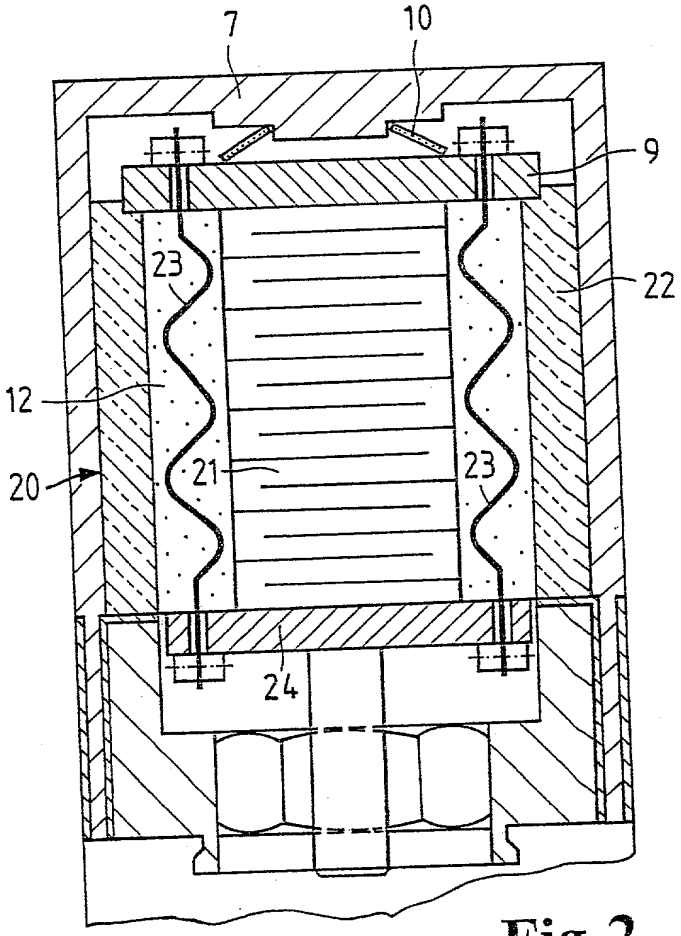

Fig.2

DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION

As a below-named inventor, I hereby declare that:

Friedrich BOECKING

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **PIEZOELECTRIC ACTUATOR** the specification of which was filed as PCT International Application number PCT/DE 00/01838 on June 6, 2000.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365 (b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior foreign application(s):			Priority claimed:	
199 28 183.1-32	GERMANY	JUNE 19, 1999	X	
(Number)	(Country)	(Date filed)	Yes	No
(Number)	(Country)	(Date filed)	Yes	No

As a named inventor, I hereby appoint the following attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Michael J. Striker, Reg. No. 27233

Direct all telephone calls to Striker, Striker & Stenby at telephone no.: (631) 549 4700 and address and all correspondence to:

STRIKER, STRIKER & STENBY
103 East Neck Road
Huntington, New York 11743
U.S.A.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement may jeopardize the validity of the application or any patent issued thereon.

Signature:	Date: 14.12.01	Residence and Full Postal Address: Mainzer Strasse 27 70499 Stuttgart Germany
Full Name of First or Sole Inventor: Friedrich BOECKING	Citizenship: GERMAN DEK	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Second Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Third Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fourth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fifth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Sixth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Seventh Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Eighth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Ninth Inventor:	Citizenship:	